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ASSIGNMENT BOOKLET 2C

SCN1270 Science 10
Module 2: Section 3 Assignment

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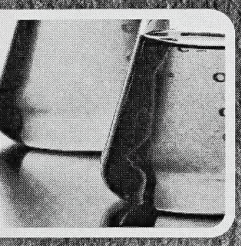
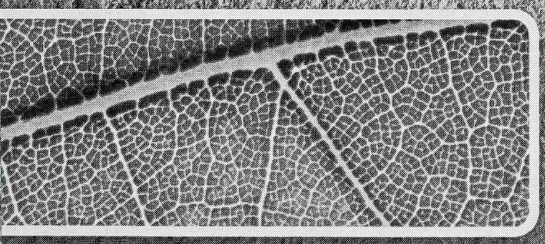
SCIENCE 10

Module 2

Energy Flow in Technological Systems





Assignment Booklet 2C

Learning Technologies Branch

Alberta EDUCATION

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Summary

	Total Possible Marks	Your Mark
Section 3 Assignment	40	

Teacher's Comments

Science 10
Module 2: Energy Flow in Technological Systems
Assignment Booklet 2C
Section 3 Assignment
Learning Technologies Branch
ISBN 0-7741-2700-7

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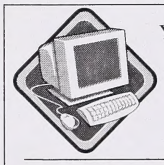
The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Assignment Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	



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- Alberta Education, **http://www.education.gov.ab.ca**
- Learning Technologies Branch, **http://www.education.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.education.gov.ab.ca**

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ASSIGNMENT BOOKLET 2C
SCIENCE 10: MODULE 2
SECTION 3 ASSIGNMENT

This Assignment Booklet is worth 40 marks out of the total 123 marks for the assignments in Module 2. The value of each assignment and each question is stated in the left margin.

Read all parts of your assignment carefully and record your answers in the appropriate places. If you have difficulty with an assignment, go back to your Student Module Booklet and review the appropriate lesson. Be sure to proofread your answers carefully before submitting your Assignment Booklet.

Section 3 Assignment: Energy Transformations and Efficiency

(40)

For questions 1 to 3, read each question carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

(1) _____ 1. Which BEST expresses the first law of thermodynamics?

A. The total energy, including thermal energy, in a system and its surroundings remains constant over time.

B. The total amount of kinetic energy and gravitational energy of a system and its surroundings remains constant.

C. An object in motion tends to stay in motion with the same velocity unless acted upon by an unbalanced force.

D. The total amount of mechanical energy of a system and its surroundings remains constant.

(1) _____ 2. Which statement represents the second law of thermodynamics?

A. Thermal energy always flows naturally from a cold object to a hot object and never naturally from a hot object to a cold object.

B. There are some processes that can remove thermal energy from a source and convert it entirely into mechanical energy.

C. Some mechanical processes can have an efficiency of 100% with no loss of thermal energy.

D. Work is needed to make thermal energy move from a cold substance to hot substance.

(1) _____ 3. Which device is a heat pump?

A. a fan
B. a jet engine
C. a wall heater
D. an air conditioning system

(2) 4. On being introduced to the laws of thermodynamics, a student retorted,

> "When the brakes of a moving car are applied, the kinetic energy of the car does diminish and even drops to zero when the car comes to a stop."

The student thought that his observation about the car contradicted the first law of thermodynamics. Does the reduction of the car's kinetic energy really contradict the first law of thermodynamics?

(2) 5. In a refrigerator, energy is used to make thermal energy flow from the inside of the refrigerator to the outside. Use a law of thermodynamics to explain why thermal energy will not move in this direction naturally.

(2) 6. Some First Nations people traditionally heated water using stones that had been heated in a fire. These hot stones were placed in water held in leather bags. The stones would heat the water. Using a law of thermodynamics, explain why the stones caused the water to heat up.

(2) 7. Perpetual motion machines have fascinated people—especially inventors—for hundreds of years before the laws of thermodynamics became known. Ideally, once energy is added to start a perpetual motion machine in motion, the machine would continue to operate indefinitely. Using a law of thermodynamics, explain why such a machine cannot be produced.

_____

_____

_____

_____

Return to page 121 of the Student Module Booklet and begin Section 3: Lesson 2.

8. In the technological development of engines, trial and error played an important role. Improved engines were often made by trial and error. That is, trying to overcome a drawback of an existing engine or the impracticality of a proposed engine design led to the development of a new engine.

Match the engines in the following list with their drawbacks. Place your answer in the blank space given.

i. gunpowder engine ii. Savery engine
iii. Newcomen engine iv. Watt engine

(½) _____ a. The boiler could not withstand the steam pressure needed to lift water beyond 6 m.

(½) _____ b. The engine had no mechanism to move the piston back to complete a cycle.

(½) _____ c. The continual reheating needed after each cooling of the engine cylinder required a tremendous amount of thermal energy.

(½) _____ d. This engine was large and massive and less efficient than thought possible.

(4) 9. Trial and error was key in the development of the internal combustion engine. Use terms from the following list to complete the paragraph. (A term may be used more than once.)

- butane
- coal gas
- compress
- Daniel Gottlieb
- decompress
- electric spark
- flint spark
- gasoline
- Gottlieb Daimler
- kerosene
- machine
- N.A. Otto
- natural gas

An early internal combustion engine invented by Philip Lebon ran on _____, which was ignited by a(n) _____. This engine was found to be too weak to operate any attached _____. _____ and Eugene Langan increased the engine power by having the engine _____ the air fuel mixture before ignition. The later engine designed by _____ used _____ instead of _____ as a fuel, making it even more powerful.

Return to page 134 of the Student Module Booklet and begin Section 3: Lesson 3.

For questions 10 to 14, read each question carefully. Decide which of the choices BEST completes the statement or answers the question. Place your answer in the blank space given.

(1) _____ 10. Technological devices are designed to convert one form of energy into another form of energy to complete a certain task. The energy that can complete the task is called

A. excess energy
B. useful energy
C. waste energy
D. input energy

(1) _____ 11. Technological devices are designed to convert one form of energy into another form of energy to complete a task. The converted energy not used to complete the intended task is called

A. mechanical energy
B. useful energy
C. waste energy
D. input energy

(1) _____ 12. The efficiency of a device is the

A. difference between the useful work output and the total input energy
B. ratio of the useful work output to the total input energy
C. ratio of the total input energy to the useful work output
D. sum of the waste energy and the useful work output

(1) _____ 13. A hoist lifts a car with a total energy input of 6.73×10^4 J. The car gains 2.35×10^4 J of gravitational potential energy during the process. What is the efficiency of the hoist?

A. 7.00%
B. 17.5%
C. 25.0%
D. 34.9%

(1) _____ 14. An internal combustion engine has an efficiency of 20.0%. This engine is used to deliver 6.00×10^4 J of work to the rest of the drive train. What is the total energy input of the engine?

A. 1.20×10^3 J
B. 4.80×10^3 J
C. 7.20×10^4 J
D. 3.00×10^5 J

(2) 15. List the following engines types in order of increasing efficiency:

- Daimler engine
- Savery engine
- Newcomen steam engine
- Otto engine

least efficient →

Watt steam engine

most efficient →

(3) 16. In studying the behaviour of bouncing balls, a couple of Science 10 students recorded the following energy values.

BOUNCING BALLS

Type of Ball	Starting Potential Energy (J)	Ending Potential Energy (J)
golf ball	0.44	0.38
tennis ball	0.56	0.30

Use these energy values to compare the percent efficiencies of the balls during the bounce. **Show your work.**

(2) 17. In heating a kettle of water on an electric stove, 3.34×10^3 J of thermal energy was provided by the element of the stove. Yet, the water in the kettle gained only 5.95×10^2 J of thermal energy. Determine the percent efficiency of the electric element in heating the kettle of water. **Show your work.**

(3) 18. A steam turbine has an efficiency of 40.0%. A steam engine has an efficiency of 25.0%. Suppose both devices are provided with 1000 J of thermal energy. How much more useful work will the steam turbine do? **Show your work.**

Return to page 144 of the Student Module Booklet and begin Section 3: Lesson 4.

Read question 19 carefully. Decide which of the choices BEST answers the question. Place your answer in the blank space given.

(1) _____ 19. Globally, which energy resource provides the most energy each year?

A. conventional oil
B. hydro-electric power
C. wind power
D. coal

(1) 20. What is the source of the input energy for the cogeneration of energy?

_____

(2) 21. List two ways a person can conserve energy.

_____

_____

_____

22. Suppose a utilities company was planning to build several power stations in Canada. The company was considering alternative ways to generate power. Imagine you were asked to advise the utilities company about the costs (or negative aspects) and benefits (or positive aspects) associated with the use of fossil fuels in thermal power stations.

(2) a. List four costs of using fossil fuels in thermal power stations.

(2) b. List four benefits of using fossil fuels in thermal power stations.

Submit your completed Assignment Booklet 2C to your teacher for assessment.

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